

CLAIMS

1. A method for fabricating a mount for an aluminum nitride (AlN) seed for single crystal aluminum nitride growth, the method comprising:
  - (a) providing a holder having a proximal base and wall portions extending therefrom to define a cavity;
  - (b) the holder being fabricated from a material selected from the group consisting of BN (boron nitride), pBN (pyrolytic boron nitride), W (tungsten), Re (rhenium), graphite, Ta (tantalum), TaN (tantalum nitride), and combinations thereof;
  - (c) disposing an AlN seed within the cavity of the holder;
  - (d) providing pellets fabricated from aluminum;
  - (e) placing the holder and seed within a nitrogen atmosphere at a temperature above the melting point of the pellets;
  - (f) dropping the aluminum pellets into the holder and onto the seed;
  - (g) permitting the pellets to melt and react with the nitrogen atmosphere to form a nitride ceramic, wherein the nitride ceramic is formed in conforming surface to surface engagement with the seed;
  - (h) repeating the dropping (f) and permitting (g) until the seed is substantially buried inside the ceramic; and
  - (i) cutting off a distal portion of the holder, ceramic, and seed, wherein the proximal end of the holder includes a proximal portion of the seed embedded within the ceramic, with the seed having an exposed crystal growth surface co-planar with a surface of the ceramic.
2. A method for fabricating a mount for an aluminum nitride (AlN) seed for single crystal aluminum nitride growth, the method comprising:
  - (a) providing a holder sized and shaped to receive an AlN seed therein, the holder fabricated from crystal growth crucible material;
  - (b) disposing an AlN seed within the holder; and

- (c) encapsulating the AlN seed within the holder with at least one of the crystal growth crucible material and a ceramic wherein the only surface of the seed crystal that is exposed is a growth surface of the seed.
3. The method of claim 2, wherein said encapsulating (c) comprises:
- (e) providing pellets of a material capable of forming a nitride ceramic by nitridation;
  - (f) placing the holder and seed within a nitrogen atmosphere at a temperature above the melting point of the pellets;
  - (g) dropping the pellets into the holder and onto the seed, and;
  - (h) permitting the pellets to melt and react with the nitrogen atmosphere to form a nitride ceramic, wherein the nitride ceramic is formed in conforming surface to surface engagement with the seed.
4. The method of claim 2, wherein said exposing (d) comprises removing a portion of the holder.
5. The method of claim 2, wherein the holder is fabricated from a material selected from the group consisting of BN (boron nitride), pBN (pyrolytic boron nitride), W (tungsten), Re (rhenium), graphite, Ta (tantalum), TaN (tantalum nitride), and combinations thereof.
6. The method of claim 2, wherein said disposing (b) comprises disposing a proximal end of the seed at a proximal end of the holder.
7. The method of claim 3, wherein said providing (e) comprises providing pellets of a material selected from the group consisting of: aluminum, titanium, yttrium, or scandium and combinations thereof.
8. The method of claim 6, further comprising providing a material capable of forming a ceramic nitride having a vapor pressure within a range of:

from less than that of AlN;  
to about 110% that of AlN.

9. The method of claim 3, comprising repeating said dropping (g) and permitting (h) until the seed is completely buried within the ceramic.
10. A combination mount and aluminum nitride (AlN) seed for single crystal aluminum nitride growth, the combination comprising:
  - a holder fabricated from crystal growth crucible material;
  - a nitride ceramic disposed within the holder;
  - an AlN seed embedded in conforming surface to surface engagement within the nitride ceramic;
  - the nitride ceramic extending 360 degrees about the AlN seed in embedded engagement therewith;
  - the nitride ceramic disposed in conforming surface to surface engagement with the holder; and
  - a crystal growth surface of the AlN seed extending free of the nitride ceramic.
11. The combination of claim 10, wherein the AlN seed is molded in-situ within the nitride ceramic.
12. The combination of claim 10, wherein the crystal growth surface is parallel to a surface of the nitride ceramic.
13. The combination of claim 12, wherein the crystal growth surface is co-planar with a surface of the nitride ceramic.
14. The combination of claim 10, wherein a portion of the seed is exposed through an opening in the holder.

15. The combination of claim 14, wherein the crystal growth surface is disposed on the exposed portion of the seed.
16. The combination of claim 15, wherein the exposed portion of the seed extends through the opening.
17. The combination of claim 16, wherein the crystal growth surface is parallel with a surface of the holder.
18. The combination of claim 17, wherein the crystal growth surface is co-planar with the surface of the holder.
19. A method for effecting seeded single crystal aluminum nitride (AlN) growth, the method comprising:
  - (a) providing a holder having a proximal base and wall portions extending therefrom to define a cavity, the holder fabricated from crystal growth crucible material;
  - (b) disposing an AlN seed within the holder;
  - (c) providing pellets of a material capable of forming a nitride ceramic by nitridation;
  - (d) placing the holder and seed within a nitrogen atmosphere at a temperature above the melting point of the pellets;
  - (e) dropping the pellets into the holder and onto the seed;
  - (f) permitting the pellets to melt and react with the nitrogen atmosphere to form a nitride ceramic, wherein the nitride ceramic is formed in conforming surface to surface engagement with the seed;
  - (g) placing the holder with the ceramic and embedded seed, within a crystal growth enclosure containing Al and N<sub>2</sub> vapor;
  - (h) cooling an exposed surface of the seed relative to other locations in the crystal growth enclosure; and
  - (i) depositing the vapor under conditions capable of growing single crystalline AlN originating at the exposed surface.

20. A method for effecting seeded single crystal aluminum nitride (AlN) growth, the method comprising:

- (a) providing a holder having a proximal base and wall portions extending therefrom to define a cavity;
- (b) the holder being fabricated from a material selected from the group consisting of BN (boron nitride), pBN (pyrolytic boron nitride), W (tungsten), Re (rhenium), graphite, Ta (tantalum), TaN (tantalum nitride), and combinations thereof;
- (c) disposing an AlN seed within the cavity of the holder;
- (d) providing pellets fabricated from aluminum;
- (e) placing the holder and seed within a nitrogen atmosphere at a temperature above the melting point of the pellets;
- (f) dropping the aluminum pellets into the holder and onto the seed;
- (g) permitting the pellets to melt and react with the nitrogen atmosphere to form a nitride ceramic, wherein the nitride ceramic is formed in conforming surface to surface engagement with the seed;
- (h) repeating the dropping (f) and permitting (g) until the seed is substantially buried inside the ceramic;
- (i) cutting off a distal portion of the holder, ceramic, and seed, wherein the proximal end of the holder includes a proximal portion of the seed embedded within the ceramic, with the seed having an exposed crystal growth surface co-planar with a surface of the ceramic;
- (j) placing the holder with the ceramic and embedded seed, within a crystal growth enclosure containing Al and N<sub>2</sub> vapor;
- (k) cooling the exposed crystal growth surface relative to other locations in the crystal growth enclosure; and
- (l) depositing the vapor under conditions capable of growing single crystalline AlN originating at the crystal growth surface.